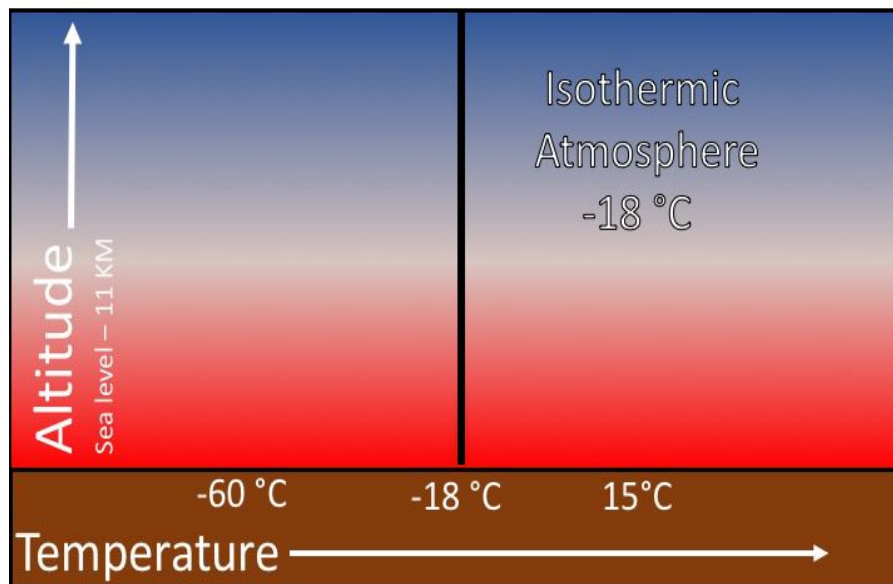


Water Vapor is a Lower Atmospheric Coolant

by Carl Brehmer

That water vapor is a lower atmospheric coolant has been demonstrated by both weather balloon soundings and surface level temperature and humidity readings for over 100 years.

To understand why, let's look at a graphic representation of the temperature profile of the troposphere—the bottom layer of the atmosphere that has an average depth of 11 km.



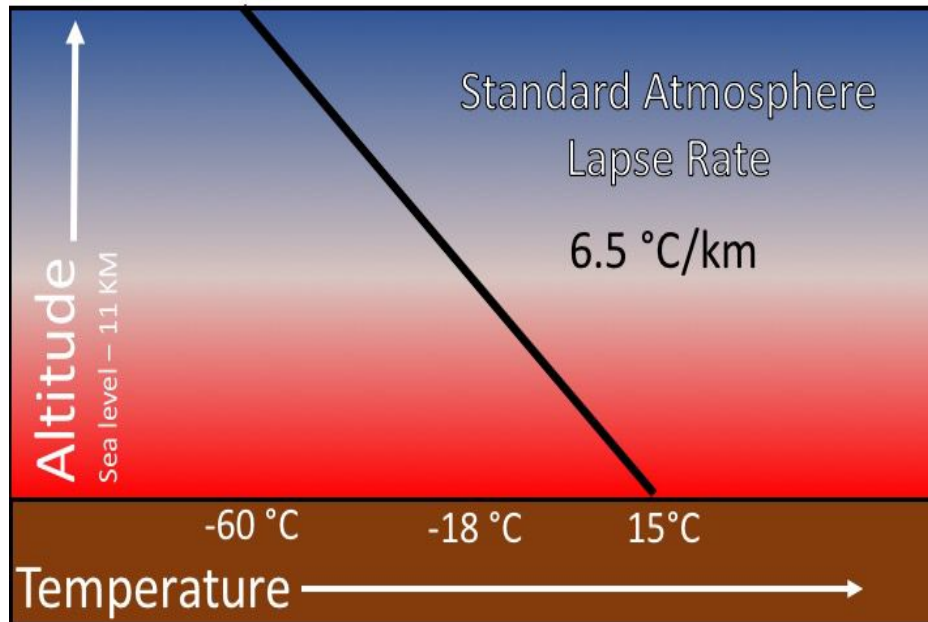
In the above graphic the vertical axes is altitude from sea-level to the tropopause—the altitude at which the air stops cooling and above which altitude the air starts warming—and the horizontal axes is temperature.

The black vertical line in the center represents what the graph would look like if the troposphere were “isothermic”, i.e., the same temperature from sea level to the tropopause.

Such a situation would occur if the thermal energy contained within the troposphere were kilogram for kilogram spread equally throughout the troposphere. For the sake of this discussion let's say that if tropospheric air were “isothermic” it would be -18 °C throughout.

Thermodynamic forces have shifted the thermal energy present within the troposphere downward toward the ground and this shift of thermal energy has on average cooled the air at the tropopause down to -60 °C and has warmed sea-level air up to 15 °C, with the temperature change pivot point of -18 °C being ~5 km in altitude—the atmosphere's center mass.

Thus, when weather balloons are released and ascend skyward they detect a steadily decreasing temperature all the way to the tropopause at ~11 km in altitude. This is called the troposphere's "lapse rate" and the International Standard Atmosphere¹ says that the average lapse rate from sea-level to the tropopause is ~6.5 °C/km as depicted in the graphic below.



The "greenhouse effect" hypothesis

As can be seen from the above graphics, the current average temperature of sea-level air is currently 33 °C higher than what its temperature would be if the troposphere were isothermic at -18 °C—if thermodynamic forces were not shifting thermal energy downward towards the surface within the troposphere.

The troposphere's hypothetical "isothermic" temperature also happens to be the Earth's "effective radiating temperature" and the "greenhouse effect" hypothesis was created to explain this shift of thermal energy towards the surface within the troposphere, which has raised surface level air temperatures some 33 °C above the mean temperature of tropospheric air. It is postulated that the radiative properties of certain gases that compose <3% of the atmosphere (primarily water vapor and carbon dioxide) warm the lower troposphere while simultaneously cooling the upper troposphere.

*"If a planet's atmosphere contains radiatively active gases the atmosphere will radiate energy in all directions. Part of **this radiation is directed towards the surface, warming it.** The downward component of this radiation – that is, the strength of the greenhouse effect – will depend on the atmosphere's temperature and on the amount of greenhouse gases that the atmosphere contains."*²

¹http://www.engineeringtoolbox.com/international-standard-atmosphere-d_985.html

²https://en.wikipedia.org/wiki/Greenhouse_effect#cite_note-3

*“Scientists . . . have observed a **cooling in the upper atmosphere**, and a **warming** at the surface and in **the lower parts of the atmosphere**. That's because greenhouse gases are trapping heat in the lower atmosphere.”³*

*“Higher concentrations of greenhouse gases **are cooling Earth's upper atmosphere while warming the planet's surface.**”⁴*

*“The net effect of [greenhouse gases] is to **strongly warm the surface [and] lower atmosphere temperature, and strongly cool the upper atmosphere temperature**, compared to if those gases did not exist.”⁵*

*“**Greenhouse gases** in the atmosphere, including water vapour, carbon dioxide . . . absorb and emit heat energy in all directions (including downwards), **keeping Earth's surface and lower atmosphere warm.**”⁶*

The above statements clearly attribute the existence of the troposphere's “lapse rate” to the “greenhouse effect”, which they say simultaneously warms the lower troposphere while cooling the upper troposphere. If the “greenhouse effect” hypothesis is true then the acuteness of the lapse rate will be directly proportional to the concentration of “greenhouse gases” particularly water vapor because it is presumed to be the most potent of all greenhouse gases.

Stated simply, according to the “greenhouse effect” hypothesis, as the concentration of water vapor (the humidity) goes down, the lapse rate will decrease because less thermal energy will be “trapped” in the lower troposphere. Let's see how much.

Since it has been estimated that between 2/3^{rds} and 3/4^{ths} of the 33 °C “greenhouse effect” is due to water vapor, the “greenhouse effect” hypothesis postulates that if there were no water vapor in the air the lapse rate would decrease significantly and the temperature of surface level air would only be 11 °C warmer than the troposphere's isothermic temperature of -18 °C.

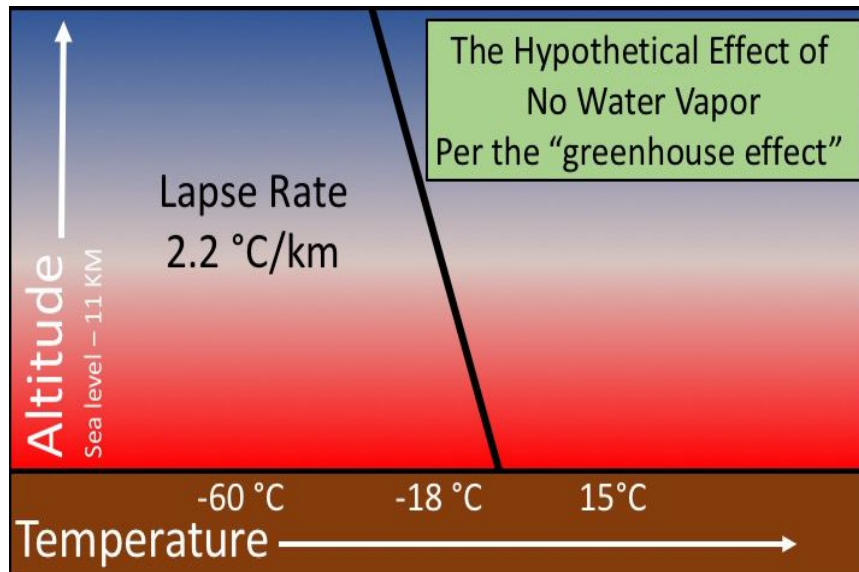
The atmosphere's isothermic temperature of -18 °C can be found at the atmosphere center mass at ~5 km in altitude. 11 °C divided by 5 km equals a lapse rate of 2.2 °C/km. Ergo, the “greenhouse effect” hypothesis asserts that without the presence of water vapor in the air —without water vapor “trapping” thermal energy in the lower troposphere—the lapse rate would only be 2.2 °C/km. Conversely, the “greenhouse effect” hypothesis asserts that the presence of water vapor in the air **increases** the lapse rate an extra 4.3 °C/km from 2.2 °C/km to its current 6.5 °C/km value.

3NASA - <http://climate.nasa.gov/causes/>

4The Christian Science Monitor - <http://www.csmonitor.com/Environment/Bright-Green/2009/1110/why-is-earths-upper-atmosphere-cooling>

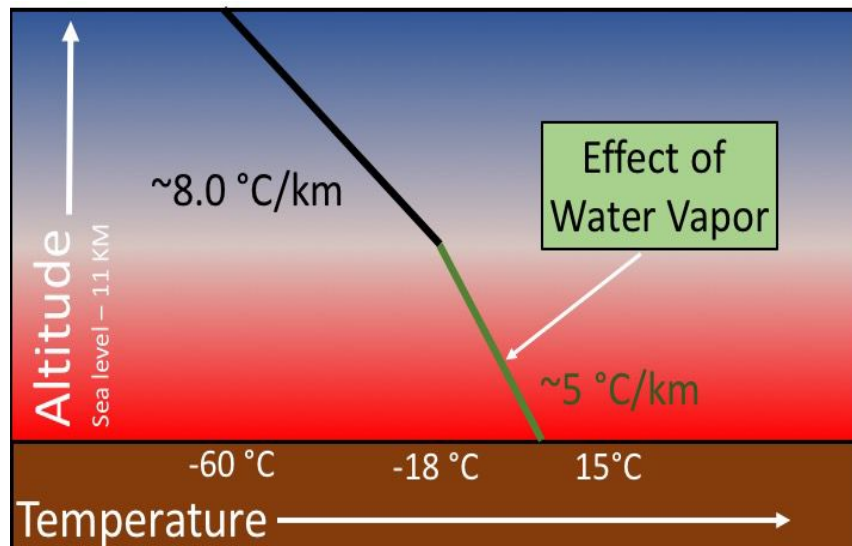
5<http://www.drroyspencer.com/2015/06/what-causes-the-greenhouse-effect/>

6Royal Society - <https://royalsociety.org/topics-policy/projects/climate-change-evidence-causes/basics-of-climate-change/>



As seen in the quotes above, the "greenhouse effect" hypothesis postulates that the lapse rate is being caused by the radiative effect of "greenhouse gases"—mostly water vapor—and it postulates that without the presence of water vapor in the troposphere its lapse rate would only be 2.2 °C/km.

This notion is falsified by hundreds of thousands of weather balloon soundings that have been taken over the past hundred years, which show universally that, far from increasing the lapse rate some 4.3 °C/km, water vapor is seen to lower the lapse rate some 3 °C/km on average as seen in the next graph.



The above graph shows the actual average effect of water vapor on the troposphere's temperature lapse rate. The International Standard Atmosphere obscures the effect of water vapor on the lapse rate by averaging its effect over the entire 11 km altitude of the troposphere. In reality, the effect of water vapor on the lapse rate is mostly a lower tropospheric phenomenon.

Because the air above 5 km is so cold, most of the water vapor has condensed out of the air by then. If “greenhouse gases” were causing the lapse rate we would expect that above 5 km in altitude the lapse rate would drop significantly as the water vapor condenses out of the air. What we see instead is an increase in the the lapse rate above 5 km in altitude.

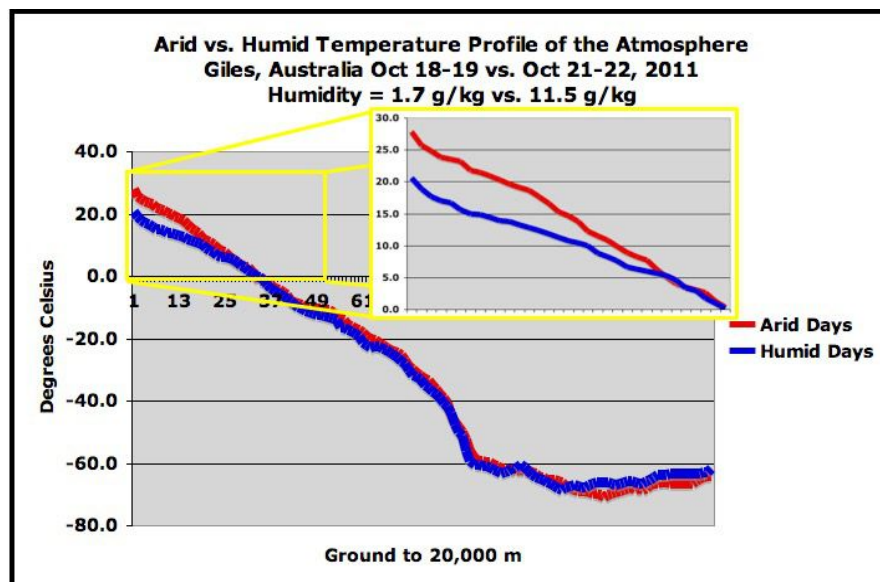
From real world weather balloon readings we observe that the average lapse rate from ~5 km to the tropopause is ~8.0 °C/km and below 5 km because of the higher humidity present there the lapse rate drops to ~5 °C/km on average.

This necessarily results in a drop in temperature of the entire lower 5 km of the troposphere and that drop becomes more pronounced as one nears sea-level. Thus, far from being a gas that is “trapping” thermal energy in the lower troposphere causing an increase in surface level air temperatures, weather balloon soundings demonstrate that water vapor is associated with cooler surface level air temperatures, i.e., as the humidity in a climate system increases its average surface level air temperature decreases.

The “greenhouse effect” hypothesis is therefore falsified by this empirical observation. That doesn’t mean that people will stop believing in it. Indeed, history has shown that orthodox scientific beliefs—such as the “greenhouse effect” hypothesis—often take generations to overturn after being falsified by empirical observation.

Some might argue that the drop in surface level air temperatures due to high humidity is compensated for by a marked increase in upper tropospheric air temperatures since latent heat transfer is simply moving thermal energy up the atmospheric column, but this is not what weather balloons show.

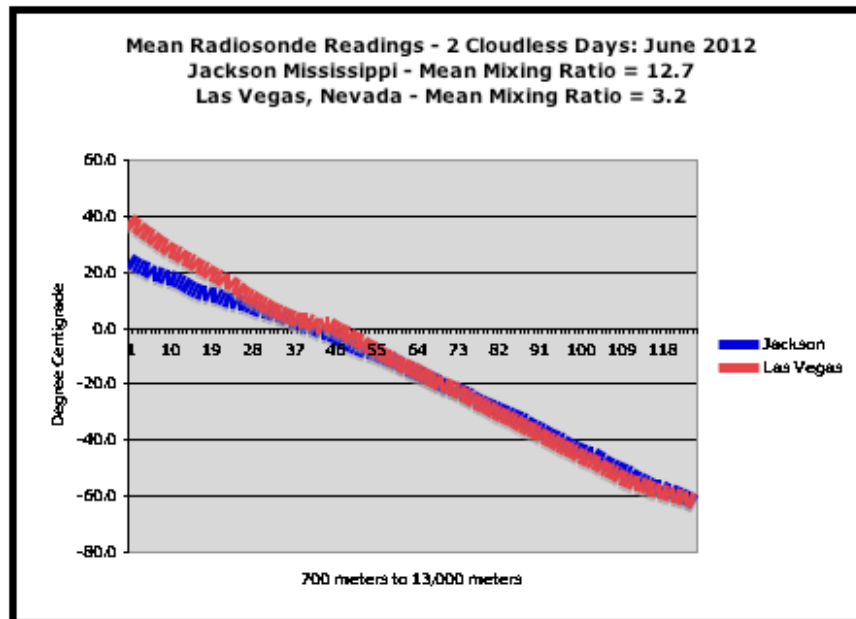
What they show is that upper tropospheric air temperatures are relatively stable irrespective of fluctuations in lower atmospheric humidity levels. Here are a couple of examples:



The above graph is from unfiltered, unadjusted weather balloon soundings over Giles, Australia before and after a thunderstorm. The vertical axes is temperature and the horizontal axes is altitude from the ground to 20 km. As you can see moving from left to right the temperature drops with altitude until at the tropopause the temperature stops getting colder and begins to warm again. The red line was a two-day average before the thunder storm and the blue line was a two-day average after the thunderstorm. The average humidity at ground level during the arid days was 1.7 g/kg and during the humid days it was 11.5 g/kg.

As you can see, the temperature profiles above 4-5 km in altitude are nearly identical and the only effect on the temperature profile of the troposphere that the extra humidity had was to lower the lapse rate of the lower 4-5 km of the troposphere, which necessarily dropped the temperature of ground level air—7 °C in this real world example

Let’s look at another example.



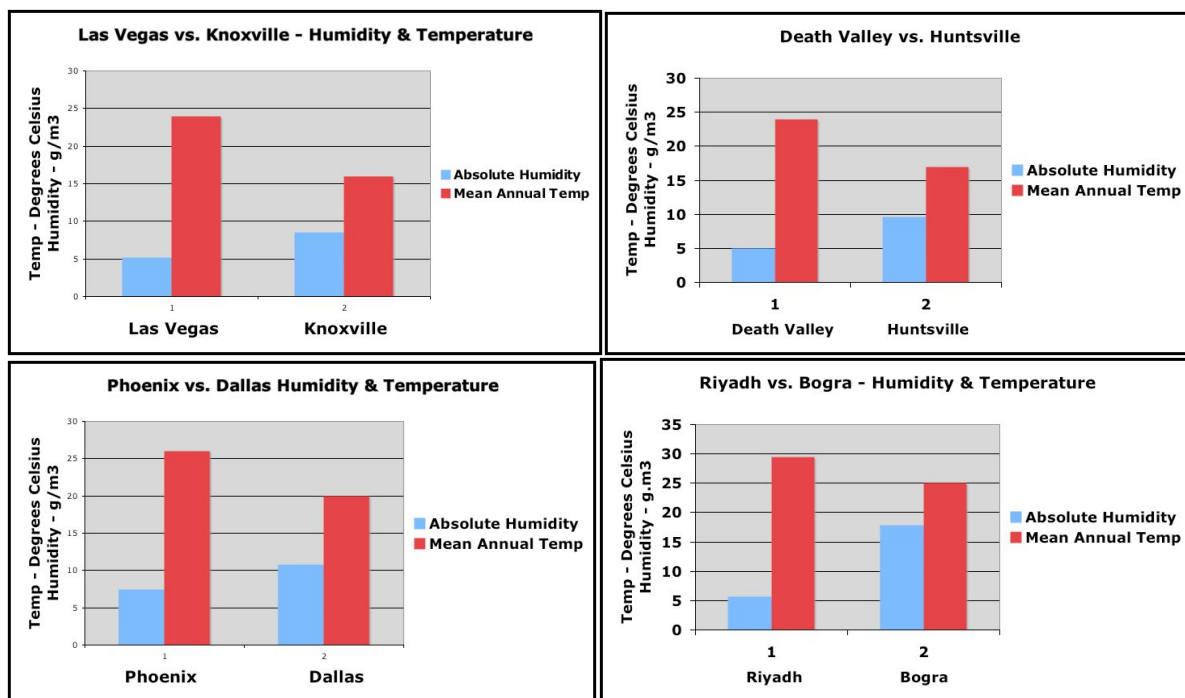
This is a graph of weather balloon soundings taken at two different locations at the same time along the same latitude. One was above Jackson, Mississippi and the other was above Las Vegas, Nevada. The vertical axes is temperature and the horizontal axes is altitude from 700 meters (the altitude of Las Vegas) to 13 km. The red line was a two-day average from the Las Vegas soundings and the blue line was a two-day average from the Jackson soundings.

The average ground level humidity in Las Vegas was 3.2 g/kg and the average ground level humidity in Jackson at the same time was 12.7 g/kg. As is universally observed by all climatologists and all meteorologists the higher humidity in the lower troposphere above Jackson resulted in a lowering of Jackson’s lapse rate below 4-5-km in altitude. As you can see this lowering of the lapse rate due to high humidity had virtually no effect on upper tropospheric air temperatures. The only possible effect therefore that this lowered lapse rate above Jackson could have had and did have was to lower ground level air temperatures—the opposite of what is predicted by the “greenhouse effect” hypothesis.

These, of course, are not isolated incidences. The fact is, one can see the cooling effect of water vapor by looking at the yearly, mean, surface-level air temperature of any humid climate compared to an arid climate that lies along the same latitude. Since climates along the same latitude receive the same amount of sunlight everyday throughout the year, if water vapor were retaining excess thermal energy this would be plainly manifest in their respective yearly mean temperatures. Also, keep in mind that the postulated warming effect of water vapor is not subtle.

The “greenhouse effect” hypothesis asserts that water vapor causes a >22 °C increase in surface level air temperatures. If such an effect actually existed the yearly mean temperatures of humid climates would be markedly higher than arid climates, but such is simply not the case.

Let’s take a look:



These are graphs of four such comparisons—Las Vegas vs. Knoxville, Death Valley vs. Huntsville, Phoenix vs. Dallas and Riyadh, Saudi Arabia vs. Bogra, Bangladesh.

The blue bars are the respective average absolute humidity in each location and the red bars are the respective yearly mean near-the-ground air temperature in each location. As you can see, in each case the more humid climate has the lower yearly mean near-the-ground air temperature, which falsifies the “greenhouse effect” hypothesis that asserts that, because of its ability to absorb and emit more IR radiation than the rest of the air, water vapor causes surface level air temperatures to increase.

QED: Water Vapor is a Lower Atmospheric Coolant and there is no “greenhouse effect”